Connected Corridors
Face-to-Face Meeting

Tuesday, Oct 27th, 2015 – 1:30 – 3:30 pm
Caltrans D7 HQ
Agenda

- Introductions
- Schedule Review
- ICM Implementation
- Outreach
- Requirements Gathering
- Architecture and Constraints
- Decision Support and AMS
- Response Plans
- Evaluation Plan
- Action Items and Closing
Our Corridor: The I-210
System Engineering “Vee” diagram

- **Planning:** Resource Allocation and Concept Refinement
- **Definition:** Requirements, System Architecture and Response Strategies
- **Build:** System Implementation and Testing
- **Operation:** Deployment, Operation and Evaluation
Systems Engineering Next Steps

- **Systems Requirements** – What should the ICM system do
- **Design Documents** – How will the requirements be met
Metro board approved call for projects funding
Requirements gathering in full swing
Requirements approval date moved to March 2016
Bi-Weekly meetings with Caltrans Office of Technology
Response plan signal plan suggestions
Evaluation plan ready for general review
## I-210 Pilot Schedule

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<th>Start</th>
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<td>3. Concept Exploration &amp; User Needs</td>
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<td>4. Corridor Preparation</td>
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<td>13. Institutional Deployment &amp; Operations</td>
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<td>16. System Validation &amp; Acceptance</td>
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**2014**
- 9/28/18

**2015**
- 9/28/18

**2016**
- 9/28/18

**2017**
- 9/28/18

**2018**
- 9/28/18

**Finish** 9/28/18
Caltrans Office of Technology
Caltrans HQ and the Requirements Process

- Bi-weekly coordination meetings between Caltrans HQ and PATH
- Headquarters looking at statewide implications, supporting I-210 and reuse
- First area of focus is the Data Management function
- Headquarters is reviewing Dallas, I-15 ICM and I-80 Smart Corridor requirements to help in developing requirements for the Data Hub
Data Management Hub

- **Data Hub contains the Extract, Transform, Load (ETL) as well as the archive and transaction databases.**

- **Several Commercial Off the Shelf (COTS) solutions for the ETL function**
  - We prefer inputs to the ETL to be in Transportation Management Data Dictionary (TMDD) format
  - Most commercial systems have this output option
  - Case by Case decision on where to transform to TMDD for legacy systems

- **Databases will store data in TMDD format**

- **Headquarters and PATH are working with D7 to reuse as much of the DCCM RSCS DSS as possible in the I-210**
ICM Current Implementation
Caltrans Organization

- System Management Principal TE
  - District Traffic Manager
    - TMC Operations
    - Incident Mgmt
    - Planned Lane Closures
    - TMP
  - System Monitoring & Evaluation
    - Managed Lanes Monitoring
    - TASAS, Table C
    - Performance Monitoring
  - System Analysis
  - Planning for Operations
  - Int/Ext Coordination
  - Corridor Manager
    - Operational Investigations
    - Safety Investigations
    - Ramp Metering
    - Signal Ops
    - Signing
    - PIDs
    - Staff from external units where needed
ICM focusing on People and Organizations

- **ICM Requires**
  - Data to know status of transportation network
  - Response plan choice
  - Implementation of response plan

- **Long term - We plan on having**
  - Significantly improved sensing and data communication infrastructure
  - A Decision Support System to assist with response plan choice
  - ITS elements capable of automatically accepting DSS generated response plan change requests

- **Next Year – We plan to have**
  - Improved sensing infrastructure and application of general knowledge by experienced personnel
  - Experienced personnel creating and selecting response plans
  - Personnel modifying ITS elements as needed to implement the response plan

- **This is a good way to:**
  - Continue to build relationships and trust
  - Ensure that automation occurs correctly
  - Have methods for dealing with situations that a DSS cannot handle
Joint operation agreement is key, COOP with all agencies for Incident Response efforts within the CC.

Main issue is lack of the sense of urgency! We need to have vehicles to respond quickly.

Legislation for Budget Authority is one recommendation from Seattle. We should do this!

PD’s working as TCO’s have public safety training but lack traffic management training. As a result traffic clearance is not a priority.

In our case, must understand how truck restrictions in Duarte and Monrovia will affect incident management and use of alternate routes.

We need to establish communication protocol on how, when and who will respond for incident management.

Joint operation is needed for moderate operations as well from the LARTMC, just like we involve local PD’s on Major events/Incidents.

Get the tow company trained on what the TIM effort is about…

We need to come up with an escalation diagram between each stakeholder.
Outreach and Funding
Funding and Agreements

- Metro Board approves Call for Projects Application for arterial improvements in September – excellent news!!!

- Letter of No Prejudice
  - Drafting LONP and work scope for Caltrans D7 to sign
  - Early funding is not an issue – Metro able to get $1.6M into FY 17 which starts July 1, 2016

- Negotiations with Metro underway to determine most feasible way to proceed with procurement

- Next Agreement – Next Set of Agreements (MOU)
  - Circulate draft document(s) before next face to face
Presentation to Jim Frazier – Chair of the Assembly Committee on Transportation

- As part of a tour of ITS we presented on Connected Corridors
  - We spoke highly of the Connected Corridors Program emphasizing the organizational changes and the successful partnerships
  - They enjoyed it, asking about additional funding and how they could help

- At lunch there was extensive conversations with Janet Dawson – Chief Consultant for the Assembly Committee on Transportation

- I asked how to convey the meeting to you all today.

- “They enjoyed hearing about such a positive program and would like to hold a legislative hearing to showcase the program and the people who are working to make it successful”

- They also asked if we would advise on new ideas and technologies
Outreach and Communications Activities

- Numerous articles mentioning Connected Corridors and new data
- Next Connected newsletter out soon
- CC Website: http://connected-corridors.berkeley.edu

- Conferences and Meetings
  - ITS California panel
  - IPAM presentation/panel
  - Joan and Nick to speak on 10/29 at Norther California ITS meeting
Foothill Gold Line Extension to Add Value and Complexity to I-210 Corridor

On September 23, the Pasadena to Azusa segment of the Foothill Gold Line extension reached substantial completion on time and on budget and was turned over to Metro for pre-revenue service. The Foothill Gold Line Construction Authority held a series of dedication ceremonies at each of the six new stations and the 24-acre Operations Campus located in Monrovia. "Reaching substantial completion is an important achievement for the entire team at the Construction Authority, Metro, and with our contractors and consultants," stated Construction Authority CEO Habib F. Balan. "We are proud to be the first light rail project funded by Measure R to have broken ground and to now be completed, and we look forward to handing the project over to Metro as they prepare to put the extension on-line in 2016."

The expansion of the Metro Gold Line will provide traveling commuters and local residents with more opportunities and an alternative mode of transportation to mobilize throughout the county. In addition to enhancing the capacity along the I-210 corridor, the completed extension encourages sustainability, supports the reduction of greenhouse gas emissions, and promotes a more active transportation community. Residents will see added value to their community and have better connection access throughout the county. In addition to the light rail expansion, residents have seen vast improvements to bicycle and pedestrian accessibility.

With an expected daily ridership of ?? and anticipated transit oriented development creating new jobs and new tax revenue around the stations, the benefits of the extension are far reaching. In 2010, the Los Angeles Economic Development Corporation released

Continued on page 2
Integrated Corridor Management Session at ITS CA
Stakeholder Celebration at ITS CA
IPAM Panel – Thank You!
Requirements
Requirements Gathering

- **Our “system”**
  - Composed of people, organizations, software and hardware
  - All must work together to accomplish our goals
  - Requirements must specify expectations for each component

- **Requirements gathering**
  - Both an educational and a definitional process
  - Requirements are emergent from interactions among users
  - How to gather emergent requirements?
Requirements: Data and Functions

- **Data**
  - Has Characteristics (Attributes) and Relationships to other data
  - Is Known, Estimated, Unknown or Non-existent
  - Has a level of quality/accuracy – Very important
  - Is stored electronically, on paper or in a person’s memory
  - Is transmitted electronically, on paper or verbally by a person

- **Functions**
  - Step by step instructions
  - Execution in a certain order
  - Decision Points (gates) determine execution order
  - Executed electronically (Automated), semi-automated or manually
  - Requires input data and generates output data
Data Requirements

- Performance Metrics & Evaluations
- Historical Patterns
- Archival / Data Warehousing

- Geographic & Institutional Data
- Transportation Networks, Hardware, Software, Departments
- Signal/Ramp Plans, Response Plans, Employees, Travelers
- Road Closures, Non-Working Devices, Unavailable Staff
- Real-Time Data, Real-Time Traveler Info
- Estimations & Predictions
- Proposed Response Plans
- Response Plans
Functional Requirements

- Institutional
- Corridor Systems Monitoring
- Incident/Event Response Planning
- Response Implementation
- Decision Support
- Data Management
- System Management
Functional Requirements

Connected Corridors
Functional Requirements

- Institutional
- Incident/Event Response Planning
- Decision Support
- System Management

Corridor Systems Monitoring (State & Perf)
Response Implementation
Data Management
Current Status – Initial Requirements Meetings

- **Cities and County**
  - Arcadia
  - Pasadena

- **Caltrans D7**
  - Maintenance
  - Ramps
  - Signals
  - TMT & LCS
  - TMC Operators
  - TMC Support

- **Caltrans HQ**
  - Maintenance
  - PEMS
  - Signals
  - TMT & LCS
  - Office of Technology

- **Metro**
  - Transit

- **SCAG**
  - Planning
Requirement Activities since last Face-to-Face

- **Meetings at ITS California**
  - 511 – Introduced ourselves to Iain Fairweather and attended 511 meeting
  - RIITS – Met with Kali Fogel for 45 minutes

- **Document Review**
  - Reviewed 511 documents provided by Iain
  - Reviewed RIITS documents provided by Kali

- **Duarte - First meeting on 10/8**

- **Joint 511 and RIITS meeting held on 10/8**

- **Met with Caltrans Office of Technology on 10/22. Established bi-weekly meetings**

- **Wrote up and distributed half of original requirements interviews**
Planned Meetings

- **Planned**
  - Duarte - Follow up meeting on 10/29 including Public Safety Officer
  - Monrovia - Meeting on 10/29 (Tina Cherry plus City Engineer and Traffic Maintenance Supervisor)
  - Metro Transit – Meeting on 10/28
  - Pasadena Transit – Meeting on 10/28
  - Caltrans Office of Technology – Every Two Weeks

- **To be setup**
  - Meeting with LA County
  - Meeting with corridor wide first responders
  - Meeting with corridor wide signal engineers
  - Meetings with specific departments in Pasadena
  - Meetings with specific departments in Arcadia
Next Steps

- Hold additional meetings
- Continue to document interview results
- Distribute initial documentation for review
- Generate requirements for review in late December
- Complete requirement approvals by March
Architecture and Constraints
Question – Verdugo Fire Center

- Is this an interface that we need to add to our diagram?
- If so, what information flows to and from it?
Design Constraints

**Considerations**
- Maintain consistency with the LA County Regional ITS Architecture
- Maintain consistency with Caltrans Strategic Systems
- Maintain consistency with existing and planned organizational structures

**Existing systems/interfaces**
- Information Exchange Network (IEN) – LA County DPW
- Regional Integration of ITS (RIITS) – Metro
- 511 – Metro
- PEMS (Performance Management System) – Caltrans
- Caltrans Reorganization around Corridors
Arterial System Schedule

- Duarte and Monrovia on KITS: Completed
- County to bring KITS onto IEN: December 2015
- IEN Contractor Selection: Spring 2016
- Pasadena i2 intersection change-over: December 2016
- Caltrans Signals on TSMSS: June 2017
- IEN Replacement System operational: October 2017
Other System Schedules

- **Metro go511 Upgrade**
  - Issue RFP: October 2015
  - Upgraded system installed: November 2016

- **Metro RIITS Upgrade**
  - Issue RIITS Modernization RFP: October 2015

- **Caltrans**
  - 210 Improvements: June 2017
  - DCCM: Dec 2016
  - Organizing around Corridors: 2016
  - PEMS Updates: TBD

- **Metro**
  - Call for Projects Approval: Sept 2015
  - Projects to begin in 2016: TBD
Constraint Questions

- Are there constraints on who is responsible for interfaces with media (radio, TV, general media)
  - 511?, Caltrans media office, others?

- Are there constraints on who is responsible for interfacing with third party providers to obtain data such as Inrix, Here, Waze?
  - Regional, Statewide?

- Are there constraints on who is responsible for providing data to third parties such as Waze, Here, Inrix, etc
  - Regional, Statewide?
Decision Support and AMS
Decision Support

- **Key Principle:** Decisions will be based on measurable, quality data

- **Decision Support needed for:**
  - Determining data quality on the corridor
  - Planning incident responses
  - Choosing incident responses in real time
  - Post incident analysis

- **Decision Support includes:**
  - Data Analysis Tools – PEMS and other Berkeley tools
  - Signal Synchronization Tools – Synchro and possibly others like TranSync
  - Micro/Meso Modeling – Aimsun and others
  - Macro models based on traffic (not behavioral) data – CC tools
  - Rules Engines for incorporating static rules (School in session for example) – Potentially DCCM work and or D4 systems
Decision Support – Modeling Status

- Integrating aspects of the following modeling tools:
  - **Synchro Corridor Model**
    - Model used for traffic signal operational analyses
    - Developed models representing 8 AM and 5 PM signal control operations
    - Based on most recent traffic counts and timing sheets provided by local agencies (as April 2014)
  - **Aimsun Corridor model** *(in development)*
    - Exploring how Aimsun could be used to help evaluation corridor aspects
    - Based on road geometry imported from Synchro, with some adjustments
    - Small networks could be extracted and set up relatively easily
    - Challenge is how to define the demand to be simulated if using whole corridor
  - **Connected Corridors Simulation Model** *(in development)*
    - Highway model – Ability to replicate a given day (demonstrated ability to meet FHWA calibration standards)
    - Arterial model – Can simulate dual-ring operations with projected phasing
  - **Pasadena VISUM Dynamic Traffic Assignment Model**
    - Exploring how to use model to extract travel demand information
Models used as part of I-210 Pilot

- **Synchro Corridor Model**
  - (8 AM, 5 PM)

- **VISUM Pasadena Model**
  - (provided by Pasadena)

- **Aimsun Corridor Model**
  - (In Development)

- **Connected Corridors Model**
  - (In Development)
I-210 Incident Response Plans

Approach

- Characterization of incidents by type
  - Minor – Moderate – Major
  - Freeway – Arterial – Transit

- Automated Response Components
  - Freeway ramp metering & ramp signal operations
  - Local arterial signal operations (designated routes only)

- Rules-Based Responses
  - Selection of alternative routes
  - Signal timing plans to implement

- Restrictive factors to consider
  - Major events and activity centers
  - Schools and other high pedestrian activity areas (senior centers, rec centers, etc.)
  - Businesses and residents
  - Bikes, pedestrians, transit grade crossings
Influence Zones
Response Example

- **Major Incident** on I-210 EB between Lake and Hill (Zone 1 only)
- **Response Example**
  - Divert to Orange Grove, Green, and Del Mar
  - Divert SB-210 to Mountain to Fair Oaks to Orange Grove
  - Increase metering rate at four downstream on-ramps
  - Reduce metering to minimum at three upstream on-ramps
Rules-Based Response Plan Example

Freeway Minor Incident (initial script)

- Reduce metering rate at ramps within 2 miles upstream
  - 50% reduction to start (adjust as needed)
  - Reduce green time to ramp intersection signal movements to on-ramps
- Increase metering rate at ramps within 2 miles downstream
  - 50% increase to start (adjust as needed)
  - More green time to ramp I/S signal movements to access on-ramps
- Increase metering rate at opposite direction ramps within 1 mile
  - 25% increase to start (adjust as needed)
- Alternative routes along local arterials
  - More green time for arterial I/S signals thru movements to downstream ramps
  - Factors to consider (for restrictive days/hours on select corridors)
Rules-Based Response Example

- **Local arterial signal modification plans (initial script)**
  - **Minor incidents** (nominal level changes)
    - Same signal phases as normal operations
    - More green time to favored movement(s), as needed
    - Local optional route(s); optional cycle lengths
  - **Medium incidents** (moderate level changes)
    - Additional optional routes
    - Modify signal phases to allow for more green time to favored movement(s) (e.g., eliminate some phases)
    - Modify signal phases/green times to deter non-essential movement towards signalized intersections downstream of incident
Example of signal timing change for medium or high level response
Rules-Based Response Plan Example

- **Local arterial signal modification plans (initial script)**
  - **Major incidents** (aggressive level changes)
    - All nearby arterials will quickly be saturated and overloaded (extreme conditions)
    - Move as much pass-through traffic out of the area as quickly as possible
    - Minimal signal phases to allow for more green time to favored movement(s)
    - Modify signal phases/green times to deter non-essential movements towards intersections downstream of incident
Next Steps

What the Team is working on
- Team to develop conceptual rules based response plans
- Team to propose initial details of
  - Alternate routes
  - Metering rates on freeway ramps upstream and downstream of incidents
  - Signal timing changes along target routes

Meeting with all local jurisdictions
- Need list of restrictions (e.g., school ped traffic) from each agency
- Discuss proposed change options
Evaluation Framework
Before/After Study Technical Memo

- Ready for review by all stakeholders
  - Evaluation approach and methodology
  - Metrics
  - Data collection needs
- We will email to all of our stakeholders
- Please review and comment before the next face to face
- We hope to collect data during the first part of next year
Why “Significant” Non-Recurrent Congestion

Not many incident-free days
Action Items and Next Meeting Time
Thank You